Government Systems Group

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DATE: March 7, 1995 PPM-95-134

TO: S. Hull/311
FROM: K. Sahu/300.1 KS
SUBJECT: Radiation Report on HST/ADD Part # UC1717SP/883B
Control #: 11002
Job #: EI56136
Generic Part #: MC1717

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A radiation evaluation was performed on MC1717 (Step Motor Driver) to determine the total dose tolerance of these parts. A brief summary of the test results is provided below. For detailed information, refer to Tables I through IV and Figure 1.

The total dose testing was performed using a ^{60}Co gamma ray source. During the radiation testing, eight parts were irradiated under bias (see Figure 1 for bias configuration), and two parts were used as control samples. The total dose radiation levels were 2.5, 5, 10, 15, 20, 30 and 50 krads*. The dose rate was between 0.15 and 1.18 krads/hour, depending on the total dose level (see Table II for radiation schedule). After the 50 krad irradiation, parts were annealed at 25°C for 168 hours. After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits** listed in Table III.

All parts passed initial electrical measurements. All parts passed all electrical tests up to and including the 10-krad irradiation level. At the 15-krad irradiation level, S/N8 fell below the minimum specification limit of 25 µs for Toff, with a reading of <10.0 µs. (This represents the minimum value which could be read by the test setup.)

At the 20-krad level, S/N 8 and 10 both read <10.0 µs for Toff.

At the 30-krad level, S/N 3, 7, 8, 9 and 10 marginally exceeded the maximum specification limit of 270 mV for vth_2, with readings ranging from 270.0 mV to 276.0 mV, and the same parts read <10.0 µs for Toff.

At the 50-krad level, all irradiated parts exceeded the maximum specification limit for vth_2, with readings ranging from 277 to 284 mV and all irradiated parts read <10.0 µs for Toff. In addition, S/N 7, 8 and 10 fell below the minimum specification limit of -20 µA for Cur leak, with readings ranging from -20.62 to 21.02 µA.

After annealing for 168 hours at 25°C, no recovery was observed. All irradiated parts passed all other electrical tests throughout all irradiation and annealing steps.

Table IV provides a summary of the mean and standard deviation values for each parameter after different irradiation exposures and annealing step.

Any further details about this evaluation can be obtained upon request. If you have any questions, please call me at (301) 731-8954.

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*The term rads, as used in this document, means rads(silicon). All radiation levels cited are cumulative.
**These are manufacturer's pre-irradiation data specification limits. No post-irradiation limits were provided by the manufacturer at the time these tests were performed.

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TABLE I. Part Information

Generic Part Number:	MC1717*
HST/ADD Part Number:	UC1717SP/883B
HST/ADD Control Number:	11002
Charge Number:	EI56136
Manufacturer:	Unitrode
Lot Date Code:	9446
Quantity Tested:	10
Serial Number of Control Samples:	1, 2
Serial Numbers of Radiation Samples:	3, 4, 5, 6, 7, 8, 9, 10
Part Function:	Step Motor Driver
Part Technology:	Bipolar
Package Style:	16-pin DIP
Test Equipment:	A540
Test Engineer:	C. Nguyen

* No radiation tolerance/hardness was guaranteed by the manufacturer for this part.

TABLE II. Radiation Schedule for MC1717

EVENTS	DATE
1) INITIAL ELECTRICAL MEASUREMENTS	01/25/95
2) 2.5 KRAD IRRADIATION (0.15 KRADS/HOUR)	01/30/95
POST-2.5 KRAD ELECTRICAL MEASUREMENT	01/31/95
3) 5 KRAD IRRADIATION (0.15 KRADS/HOUR)	01/31/95
POST-5 KRAD ELECTRICAL MEASUREMENT	02/01/95
4) 10 KRAD IRRADIATION (0.29 KRADS/HOUR)	02/01/95
POST-10 KRAD ELECTRICAL MEASUREMENT	02/02/95
5) 15 KRAD IRRADIATION (0.29 KRADS/HOUR)	02/02/95
POST-15 KRAD ELECTRICAL MEASUREMENT	02/03/95
6) 20 KRAD IRRADIATION (0.29 KRADS/HOUR)	02/06/95
POST-20 KRAD ELECTRICAL MEASUREMENT	02/07/95
7) 30 KRAD IRRADIATION (0.59 KRADS/HOUR)	02/07/95
POST-30 KRAD ELECTRICAL MEASUREMENT	02/08/95
8) 50 KRAD IRRADIATION (1.18 KRADS/HOUR)	02/08/95
POST-50 KRAD ELECTRICAL MEASUREMENT	02/09/95
9) 168-HOUR ANNEALING @25°C	02/09/95
POST-168 HOUR ANNEAL ELECTRICAL MEASUREMENT	02/16/95

PARTS WERE IRRADIATED AND ANNEALED UNDER BIAS; SEE FIGURE 1.

Table III. Electrical Characteristics of MC1717

TEST CONDITIONS: VCC = 5V, VR = 5V VM = 10V unless otherwise noted;
Rt =56Kohms, Ct = 900pF, Rc = 1Kohms, Rsense = 1 ohm
Test temperature : 25oC

tst	Test name	Min	Max	Condition
1	I Supply	0.00 ma	25.00 ma	Vcc = 5.25v
10	Phase iih		20.00 ua	Vi =2.4V
11	I0 iih		20.00 ua	Vi =2.4V
12	I1 iih		20.00 ua	Vi =2.4V
13	Phase iil	-400.0 ua	0.0 ua	Vi =0.4V
14	I0 iil	-400.0 ua	0.0 ua	Vi =0.4V
15	I1 iil	-400.0 ua	0.0 ua	Vi =0.4V
20	VR leak	-20.00 ua	20.00 ua	
21	Cur leak	-20.00 ua	20.00 ua	
22	vth_1	390.00 mv	440.00 mv	I0=0,I1=0
23	vth_2	230.00 mv	270.00 mv	I0=1,I1=0
24	vth_3	65.00 mv	90.00 mv	I0=0,I1=1
30	Iout		100.0ua	I0=1,I1=1
40	Toff *	25.00 us	35.00 us	Ton > 5us,

*The lower limit of measurement capability of the test equipment for Toff was 10.0 µs.

TABLE IV: Summary of Electrical Measurements after Total Dose Exposures and Annealing for MC1717 /1

Test #	Parameter	Units	Spec. Lim./2 min	Spec. Lim./2 max	Initial mean	Initial sd	Total Dose Exposure (krads) 2.5 mean	2.5 sd	5 mean	5 sd	10 mean	10 sd	15 mean	15 sd	20 mean	20 sd	30 mean	30 sd	50 mean	50 sd	Annealing 168 hrs @25°C mean	Annealing 168 hrs @25°C sd
1	I Supply	mA	0	25	17.6	1.5	18.3	1.9	20.6	1.7	21.1	1.3	21.4	.45	21.4	.27	21.4	.25	21.2	.25	21.3	.25
2	Phase iih	µA	-	20	-0.80	.08	-1.00	.12	-0.80	.07	-0.80	.10	-0.90	.10	-0.90	.10	-0.90	.11	-1.00	.09	-0.80	.12
3	I0 iih	µA	-	20	-0.80	.10	-0.90	.17	-0.80	.10	-0.80	.15	-0.90	.16	-0.80	.11	-0.80	.10	-1.00	.07	-0.80	.09
4	I1 iih	µA	-	20	-0.90	.14	-1.00	.07	-0.80	.16	-0.70	.19	-0.90	.07	-0.80	.05	-0.90	.11	-1.00	.07	-0.90	.18
5	Phase iil	µA	-400	0	-3.00	.19	-4.00	.24	-5.00	.39	-7.00	.45	-9.00	.90	-11.0	.98	-14.0	1.0	-18.0	1.0	-14.0	1.0
6	I0 iil	µA	-400	0	-142	2.0	-141	2.0	-140	2.0	-138	2.0	-136	2.0	-134	2.0	-130	2.0	-124	3.0	-129	2.0
7	I1 iil	µA	-400	0	-142	2.0	-141	2.0	-139	2.0	-137	3.0	-136	3.0	-134	3.0	-129	3.0	-123	3.0	-129	3.0
8	VR leak	µA	-20	20	2.00	.88	3.00	1.0	2.00	1.0	2.00	1.0	2.00	1.0	2.00	.88	1.00	0	0.63	2.0	2.00	0
9	Cur leak	µA	-20	20	-5.00	.26	-7.00	.12	-8.00	.20	-10.0	.40	-12.0	.61	-13.0	.56	-16.0	.79	-20.0	.84	-16.0	.75
10	vth_1	mV	390	440	403	1.1	404	3.9	402	0	404	4.2	404	5.7	404	6.3	408	8.3	402	0	410	11
11	vth_2	mV	230	270	248	1.8	250	1.9	252	1.7	255	1.6	259	2.9	264	2.6	272	3.2	281	3.0	278	3.3
12	vth_3	mV	65	90	73.4	.52	73.5	.54	73.8	.71	74.5	.76	76.8	1.5	77.9	1.5	80.0	1.9	83.5	2.1	82.5	1.6
13	Iol	µA	-	100	7.00	.16	7.00	.17	7.00	.26	7.00	.24	7.00	.22	7.00	.13	7.00	.21	7.00	.14	7.00	.25
14	Toff /3	µs	25	35	34.0	.11	33.0	.15	33.0	.31	31.0	.41	7P1F		6P2F		3P5F		F		F	

Notes:

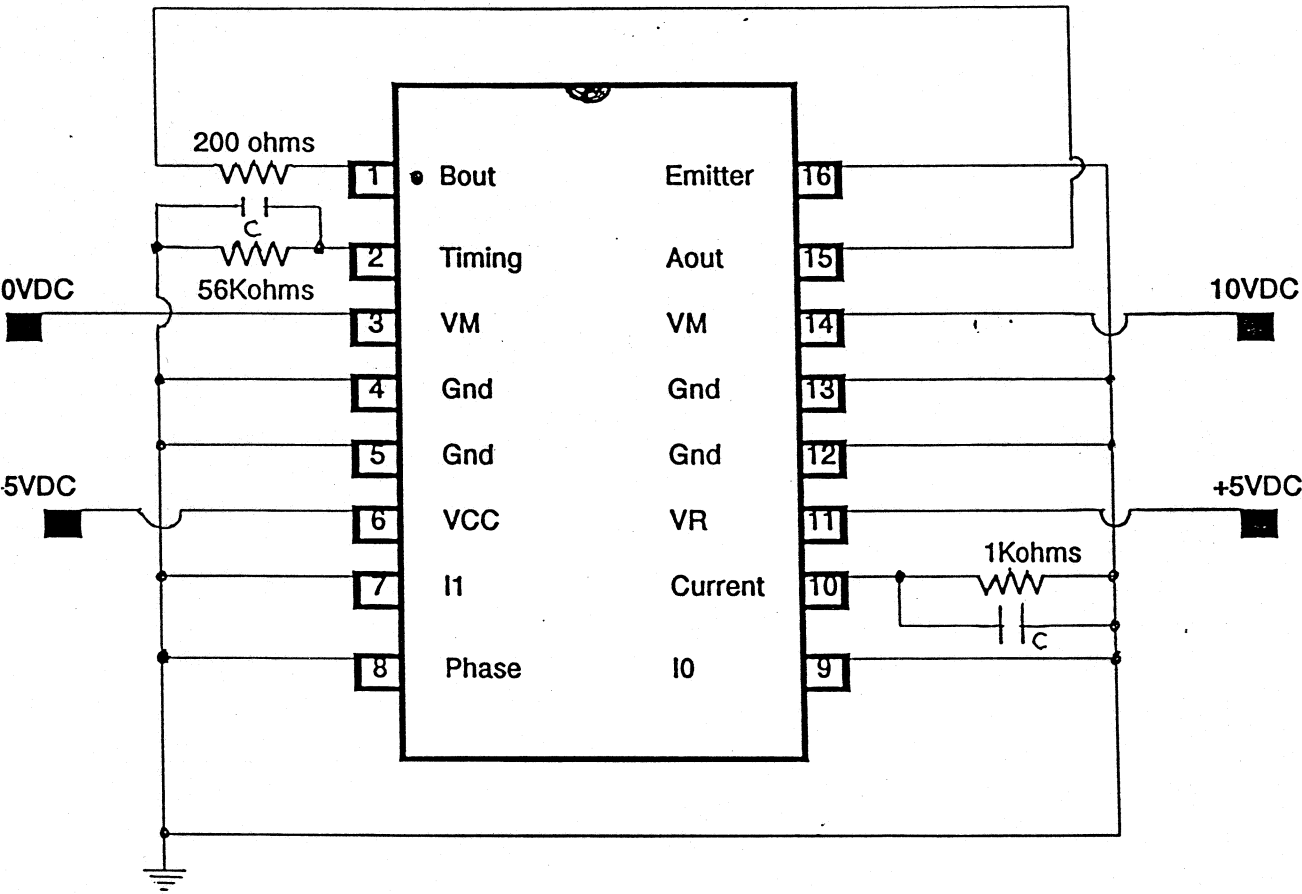
1/ The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout the testing and are not included in this table.

2/ These are manufacturer's pre-irradiation data sheet specification limits. No post-irradiation limits were provided by the manufacturer at the time the tests were performed.

3/ The minimum measurement capability of the test setup for Toff was 10.0 µs, therefore, when the reading for any part fell below 10.0 µs, the results are given as "nPmF", where n parts passed the test and m parts failed. "F" means that all parts failed the test at this radiation or annealing level.

Radiation-sensitive parameter: Toff, vth_2, Cur leak.

Figure 1. Radiation Bias Circuit for MC1717



1) All resistors are ±10%, ½W.
2) All capacitors are 1 nF.